

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE MARYLAND GEOLOGICAL SURVEY,
EDWARD BENNETT MATHEWS, STATE GEOLOGIST.

SOIL SURVEY OF HOWARD COUNTY, MARYLAND.

BY

WILLIAM T. CARTER, JR., OF THE U. S. DEPARTMENT OF AGRICULTURE, IN CHARGE, AND J. P. D. HULL, OF THE MARYLAND GEOLOGICAL SURVEY.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1916.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 5, 1917.

SIR: Under the cooperative agreement with the Maryland Geological Survey a soil survey of Howard County was carried to completion during the field season of 1916. The selection of this area was made after conference with State officials.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1916, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF HOWARD COUNTY, MARYLAND.

By **WILLIAM T. CARTER, Jr.**, of the U. S. Department of Agriculture, In Charge, and **J. P. D. HULL**, of the Maryland Geological Survey.—Area Inspected by **W. EDWARD HEARN**.

DESCRIPTION OF THE AREA.

Howard County lies in central Maryland, the extreme eastern part being about 8 miles southwest of Baltimore and the southeastern corner about 20 miles north of Washington, D. C. It is bounded on the north by Carroll County, on the northeast by Baltimore County, on the southeast by Anne Arundel County, on the south by Montgomery and Prince Georges Counties, and on the west by Montgomery County. Frederick County touches it at the extreme northwest. Its northern boundary is marked by the Patapsco River, while the Patuxent River constitutes the boundary along the south and west. Howard County has an area of 253 square miles, or 161,920 acres. It is the second smallest county in Maryland.

Physiographically, Howard County is a thoroughly dissected plateau. A large number of small streams have cut narrow valleys and have produced in general a gently rolling to strongly rolling topography over the entire county. Along the larger streams, including the Patapsco and Patuxent Rivers, where the valleys are deepest, some areas are rather steeply sloping to hilly. On the broader drainage divides the surface of considerable areas is gently undulating. Very few slopes are too steep for cultivation. The smoother areas

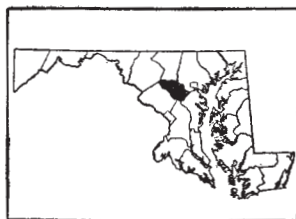


FIG. 1.—Sketch map showing location of the Howard County area, Maryland.

occur mostly in the central part of the county, in the vicinity of Atholton, Elioak, Pine Orchard, Mayfield, Cooksville, and Glenwood, while the roughest areas occupy steep slopes along the Patapsco River close to the northern and northeastern border of the county, near Ellicott City and Elkridge. The Coastal Plain area in the southeastern part of the county is gently to strongly rolling. Flat areas of bottom land occur along streams in all parts of the county.

Elevations above sea level in Howard County range from about 50 feet in the extreme eastern part to a little over 850 feet in the

western section. The greater part of the county lies between 300 and 700 feet above sea level. The elevation at Elkridge is about 50 feet, at Laurel about 150 feet, at Atholton 359 feet, at Pine Orchard 426 feet, and at Lisbon 592 feet. The general slope of the county is southeasterly.

The Patuxent River drains the greater part of Howard County. This stream rises in the extreme northwestern corner of the county and flows in a general southeasterly direction along the southwestern and southern boundaries. It has a swift current, falling about 650 feet in its course of about 25 miles along the county. The Patapsco River drains a narrow belt of country along the northern and eastern border of the county. This stream rises in the extreme northwestern part of the county, near the source of the Patuxent River, and follows a winding course of about 35 miles along the northern and eastern county lines, falling about 750 feet in this distance. The Little Patuxent River drains a large part of the eastern half of the county, emptying into the Patuxent a few miles outside the county. The Middle Patuxent drains a large area in the central part of the county. The flood plains of these larger drainage ways lie 50 to 200 feet below the general level of the uplands 1 or 2 miles back.

Considerable water power can be developed along these main streams, and some power, largely along the Patapsco, is now used in operating flour and cotton mills. The various streams are actively eroding their channels. Numerous small branches and intermittent streams reach all parts of the county, giving complete drainage. Erosion is severe on some of the steeper slopes, especially where the surface is unprotected. The stream bottom lands are occasionally inundated for short periods.

Howard County was formed from Anne Arundel County in 1850. The early settlers were English or of English descent, and doubtless came from the older tidewater Maryland settlements. The population of Howard County in 1910, according to the census, was 16,106. Most of the inhabitants are descendants of the original settlers in Howard or other Maryland counties. There are several hundred people of foreign descent, mostly German, scattered throughout the county. Over 23 per cent of the population is colored. The majority of the people are engaged in agricultural pursuits. The least thickly populated section is in the rougher areas near the Patapsco and Patuxent Rivers.

Ellicott City, the principal town and county seat, with a population of 1,151, is situated near the northeastern corner of the county. Elkridge and Savage are smaller towns in the eastern part of the county. Mount Airy, near the northwestern corner in Carroll

County, and Laurel, just outside the county on the south, are trading centers for the surrounding farming communities. There are several smaller towns along the railroads and elsewhere in the county.

The main line of the Baltimore & Ohio Railroad follows the Patapsco River along the northern and eastern borders of the county, and the Washington branch of the same system closely follows the southeastern boundary. Ellicott City is connected by a trolley line with Baltimore. Another trolley line reaches from Washington to Laurel. The southern part of the county northwest of Laurel is the farthest from railroads, some farms being 10 or 12 miles from a station. Two excellent State highways traverse the county, the Frederick turnpike extending northwestward from Ellicott City through the northern part of the county for a distance of about 20 miles, and the Baltimore-Washington Road crossing the southeastern part. Considerable passenger and freight hauling is done over these roads by automobile. There are several miles of other State-built roads in the county. The dirt roads are as a rule quite good. Nearly all parts of the county are reached by rural mail delivery or are on star routes over which mail is carried daily. The telephone is in general use, and there are good schools and churches in all parts of the county.

Baltimore is the principal market for the agricultural products of the county. Some of the products of the southern part are sold in Washington. The small towns within the county consume some of the farm products, and the local mills utilize considerable grain.

CLIMATE.

Howard County has a healthful, temperate climate, free from prolonged hot or sultry weather in the summer or extreme cold in the winter. The mean annual temperature is about 55° F. The average date of the last killing frost in the spring is April 5, and that of the first in the fall, November 4. This gives an average growing season of 213 days. The latest recorded frost in the spring occurred on May 12 and the earliest in the fall on October 6.

The mean annual precipitation of 43.18 inches is well distributed throughout the year. Practically all the precipitation occurs in the form of rain. The average annual fall of snow is 23.9 inches. Periods of excessively dry weather are unusual and of short duration, and crops are rarely damaged by drought.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded by the Weather Bureau station at Baltimore, the nearest point for which complete records are available.

Normal monthly, seasonal, and annual temperature and precipitation at Baltimore.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1870).	Total amount for the wettest year (1854).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	36.9	73	— 3	3.08	1.04	3.90	4.2
January.....	33.4	74	— 6	3.22	2.00	4.40	6.1
February.....	34.6	78	— 7	3.51	1.50	4.90	7.5
Winter.....	35.0	78	— 7	9.81	4.54	13.20	17.8
March.....	41.9	86	5	3.88	1.90	4.70	4.5
April.....	53.0	94	12	3.27	3.03	7.20	.6
May.....	64.2	96	34	3.56	2.52	5.20	T.
Spring.....	53.0	96	5	10.71	7.45	17.10	5.1
June.....	73.0	99	46	3.84	3.37	4.80	0
July.....	77.3	104	55	4.82	.35	2.60	0
August.....	74.7	100	51	4.21	1.68	3.00	0
Summer.....	75.0	104	46	12.87	5.40	10.40	0
September.....	68.6	101	39	3.85	1.76	4.10	0
October.....	57.5	90	30	3.02	3.00	7.10	T.
November.....	45.8	79	15	2.92	.28	7.30	1.0
Fall.....	57.3	101	15	9.79	5.04	18.50	1.0
Year.....	55.1	104	— 7	43.18	22.43	59.20	23.9

AGRICULTURE.

Agriculture always has been the principal industry of Howard County. The first crops grown were doubtless the same as those of the tidewater settlements—namely, tobacco, corn, and vegetables. Tobacco dominated the early agriculture in Maryland and continued the staple crop for many years. It is said that the tobacco produced on the Howard County soils was superior in quality to that grown on the soils of the Coastal Plain counties and that higher prices were paid for it. Elkridge was a port of entry, and much tobacco was shipped from that point to England, Germany, and France. The establishment in 1772 of flour mills on the Patapsco River near the present site of Ellicott City stimulated the production of wheat. Between 1825 and 1840 tobacco growing gave way largely to the production of corn, wheat, and hay. The raising of beef cattle and horses was an important industry until the Civil War period.

While farming was carried on more or less successfully for many years, it is only during the last half century that the soils over much

of the county have been brought to a high state of productiveness. Much of the land that 30 or 40 years ago was considered rather poor has been greatly improved by the use of lime and commercial fertilizers, the keeping of more cattle and other stock, the growing of clover, and the plowing under of organic matter.

According to the census there were 18,445 acres in wheat in 1879, producing 305,555 bushels. Corn occupied 17,925 acres, producing 505,864 bushels. Hay was cut from 11,176 acres, with a production of 11,494 tons. There were 2,586 acres in oats, producing 46,594 bushels. A small acreage was devoted to rye and tobacco. Over \$30,000 worth of orchard and market-garden products were sold.

The census of 1890 showed little change in the acreage devoted to wheat and corn. Hay was cut from 20,766 acres in 1889, with a production of 23,205 tons. Nearly 2,000 acres were devoted to rye.

By 1899 the acreage in wheat had grown to 25,941 acres, with a production of 416,570 bushels. Corn occupied 19,885 acres, with a production of 782,680 bushels. Over 16,000 acres were cut over for hay. Nearly 1,200 acres were planted to Irish potatoes, which produced 74,100 bushels. The value of all orchard products in 1899 was \$39,302, and of small fruits \$14,823. Animals sold or slaughtered amounted in value to \$133,735; dairy products, excluding those used in the home, \$116,089; and poultry products \$52,997.

The prevailing type of agriculture in Howard County has been the same for many years. It consists of the production of the general farm crops, wheat, corn, and hay (either for sale or for use on the farm), dairy farming, the feeding of beef cattle, and hog raising. On farms convenient to the large cities some market gardening and fruit growing are carried on. A small acreage is devoted to potatoes, rye, oats, and tobacco.

Wheat occupies a larger acreage than any other crop, and constitutes the principal cash product. The total acreage in wheat has changed little within the last 15 or 20 years. The census of 1910 reports an area of 24,205 acres, with a production of 427,428 bushels. Much of the crop is used on the farm or sold to local mills, but the greater part is shipped to Baltimore.

Corn is the second most important crop. It is grown to some extent on all farms. The census of 1910 reports 19,909 acres devoted to corn, producing 634,551 bushels. Considerable corn is grown for ensilage. Part of the crop is hauled to Baltimore or near-by towns, but the greater proportion is used for feeding work stock, dairy animals, beef cattle, hogs, and poultry.

Hay ranks third in importance. The census of 1910 reports 17,338 acres in all tame grasses, with a production of 17,655 tons. Of this total 9,978 acres were in mixed timothy and clover, and 6,709 acres in timothy alone. The bulk of the hay is fed on the farms to work stock,

beef cattle, and dairy cows. Some is hauled or shipped to Baltimore. Alfalfa is grown in small fields and apparently is fairly successful.

Oats often give rather low yields, and are not grown extensively. Rye is grown in small fields on some farms. Tobacco, a pipe-smoking type, at present is grown on only a few farms. The census reports only 65 acres planted to tobacco in 1909, with a total production of 60,755 pounds.

In the eastern part of the county a considerable area is devoted to vegetables and fruit, the products being hauled to Baltimore or sold to canning factories located in various small towns, including Mount Airy, Watersville, Jessups, and Laurel. Frequently farmers produce vegetables for market or for canning in connection with general farming. The chief canning products are tomatoes, sugar corn, beans, peas, and some fruit. Strawberries and other berries are grown by many market gardeners for the Baltimore market. Farmers in the eastern part of the county plant several acres of Irish potatoes, mainly for the late or main crop. The McCormick and Twentieth Century are leading varieties. The potatoes are sold locally and in Baltimore. Practically every farm has an orchard consisting of apples alone or of apples with one or more of the following fruits: Peaches, pears, plums, and cherries. The surplus fruit is sold locally or in Baltimore. There are a few small commercial orchards in the eastern part of the county, the largest in the vicinity of Ellicott City. The principal varieties of apples are the Grimes, Stayman Winesap, Ben Davis, and York Imperial. The census reports 1,442 acres in Irish potatoes in Howard County in 1909, with a production of 91,241 bushels; 35 acres in sweet potatoes; and 1,426 acres in all other vegetables. The total value of the vegetables produced that year was \$143,810 and of fruits and nuts \$100,743.

According to the census, the total value of all farm products of Howard County in 1909 was \$2,214,100. Of this the cereals were valued at \$887,727 and hay and forage crops at \$268,320. Animals sold or slaughtered amounted in value to \$335,725.

The same authority reports 5,022 dairy cows in Howard County. Many farmers within a few miles of the railroads or State highways do considerable dairying. The value of the dairy products in 1909, excluding those consumed in the home, was \$155,577. Dairying is carried on to a considerable extent in conjunction with general farming. There are some rather large dairy farms. Most of the dairy herds contain from 5 to 30 cows, though some are larger. A number of farmers at some distance from railroads make butter on the farm for sale in near-by towns or to hucksters. The dairy cattle are usually Jersey or Holstein or grades of these breeds. Practically all the milk and cream produced is sold in Baltimore. A small amount is shipped to Washington, and some is used by a few small

creameries for butter making. Many farmers use silos, the number of which is gradually increasing.

The feeding and fattening of steers for market is also of considerable importance. According to the census, more than 1,000 head of cattle were fed in 1909. These steers are shipped from the West—largely from Chicago—or from West Virginia, and a number of farms carry 10 to 60 head. Cattle are marketed principally in Baltimore. Some are shipped to other eastern markets. The steers are bought late in the fall and are either fattened in a few months or kept for a year or more. They are grazed and fed ensilage, hay, and corn, and such concentrates as linseed meal and cottonseed meal. The census reports the number of calves sold or slaughtered in 1909 as 3,022, and of other cattle as 3,446. On a few large farms fine beef cattle are raised, but the raising of beef stock on the whole is not an important industry.

Nearly every farmer raises a few hogs, and there are small flocks of sheep throughout the county. Hogs are raised primarily to supply fresh pork, bacon, and lard for home use, but many farmers sell a few animals each year in the local towns or ship them to Baltimore. The census reports 10,438 hogs and 2,138 sheep sold or slaughtered in 1909. Poultry and eggs to the value of \$200,833 were produced in that year. Poultry raising is a special industry on only a few farms, but is engaged in on a small scale by every farmer.

As a rule the farmers of Howard County have fairly definite knowledge of the crop adaptations of the various soils of the county, so far as the crops commonly grown are concerned. They recognize that the Chester loam, Manor slate loam, Montalto clay loam, and Mecklenburg loam are especially good types for the production of corn, wheat, and grass, while the Sassafras loam and Leonardtown loam are considered fairly good for these crops with the best of tillage and fertilization. The Manor loam, micaceous phase, is recognized as a good potato and fruit soil, and as a good corn soil where well fertilized, but it is considered rather too light for best results with wheat and grass. It is well known that the Sassafras loamy sand is better suited to vegetables than to other crops. The stony and gravelly soils are considered better suited to fruit growing or forestry than to the growing of cultivated crops. While the Congaree silt loam and Ochlockonee loam are inherently good corn soils, under present drainage conditions it is recognized that they are better suited to grass for hay and pasturage than to cultivated crops.

In growing corn the land is plowed in the fall or spring to a depth of 6 or 8 inches. Usually the farmers plow in the fall, but this is not always possible. The surface is left rough, to permit more

thorough weathering during the winter. In the spring the land is harrowed several times before seeding. Corn is cultivated 3 or 4 times. Wheat is drilled in on corn land in the fall without plowing, but often the land is harrowed before seeding to remove trash and weeds. Where wheat is grown for two successive years on the same field the stubble land is plowed just after harvest and is dragged and harrowed several times before seeding the next crop. Grass seed, usually timothy, is drilled in with wheat in the fall where wheat is not to succeed itself, and the following spring red clover is sowed in the wheat and grass. After the wheat is harvested the timothy and clover are cut for hay the following year. The timothy is pastured or cut for hay for another year, when the land is again plowed for corn. Wheat is generally grown two years in succession on the same land, grass and clover being sown with the last crop of wheat.

Over the greater part of Howard County the farm buildings are large and substantial. Many houses are of stone. The barns usually are large, with stone foundations and of the "bank-barn" type. The sheds and corn cribs are well built, and the farm machinery is usually sheltered. The houses, barns, and outbuildings are painted and kept in good condition. Farm fences are largely of wire. The horses used for farm work are a medium-sized draft type. As a rule improved machinery of good quality is used. Usually the turning plows are of the walking type and are drawn by 3 or 4 horses. Thrashing is done by traveling outfits.

Commercial fertilizer of various formulas is used on practically every farm. In 1909, according to the census, 70.5 per cent of the farms in the county expended, on an average, \$125 each for fertilizers. Nearly all the fertilizer is used for wheat, but some is used for potatoes, vegetables, and occasionally corn. As a rule the preparations contain 8 or 10 per cent phosphoric acid, 1 or 2 per cent of nitrogen, and 1 to 2 per cent of potash. Somewhat higher grades of complete fertilizers are sometimes used for potatoes and vegetables. Recently the farmers have begun a more extensive use of ground phosphate rock, containing 14 or 16 per cent of phosphoric acid. From 300 to 500 pounds of fertilizer per acre is used for wheat.

Lime is used by most farmers, and is generally considered a necessity. It produces good results on most of the soils. Lime is usually spread on land to be used for wheat, grass, and sometimes corn. Where quicklime is used, 20 to 30 bushels per acre is applied every 5 to 8 years, or a smaller application is made more frequently. Owing apparently to ease in handling, hydrated or slaked lime is rapidly becoming more commonly used, although the cost is consider-

ably greater. Hydrated lime is applied about every 3 to 5 years, at the rate of 700 to 1,000 pounds per acre. It is applied in the fall on land intended for wheat and grass, and in the spring on cornland.

Practically all the barnyard manure made on the farm is applied to corn or grass land. Many farms do not produce as much manure as is needed, some is hauled from the towns or shipped from Baltimore, the latter mainly by market gardeners.

Labor is rather scarce in Howard County, owing largely to the employment of men in Baltimore and by various outside industries. Much of the labor is colored. Wages vary considerably, depending on the season, the character of the work, and the period of employment. Hands employed by the year are paid about \$15 to \$25 a month, in addition being given the use of a house and firewood and supplied with some articles of food. Day labor is paid \$1 to \$1.50, with board, and during the period of wheat or corn harvest \$1.50 to \$2.50 a day, with board. Over 70 per cent of the farms in the county used hired labor in 1909, expending on an average \$345 each.

The farms of Howard County ordinarily range in size from 80 to 200 acres. Some farms are as small as 50 acres, a few comprise 300 to 500 acres, and in the central part of the county there are some individual holdings of more than 1,000 acres. These are frequently the remnants of grants given in the period of early settlement of Maryland. Large areas in these holdings remain in the original forest growth. The census of 1910 gives the average size of farms in Howard County as 107.6 acres. The average size has changed little in the last 30 years. About 80 per cent of the farms are operated by owners, 3.3 per cent by managers, and the remainder by tenants. Tenants generally remain several years on the same farm. Farm leases are usually on a share basis. Approximately one-half the crop produced commonly goes to the landowner, but the proportion varies to some extent, depending on what is furnished by the landlord. The census of 1910 reports 1,385 farms in Howard County. The improved land averages 82.3 acres per farm, or 76.5 per cent of the farm area.

The average value of all farm property in 1910 was \$7,290 per farm, of which the land represented 50.5 per cent, buildings 33.5 per cent, implements 4.9 per cent, and domestic animals, poultry, and bees 11.2 per cent. Land prices vary considerably, depending on the soil, improvements, transportation facilities, topography, and location. Land values are higher in the eastern part of the county within easy hauling distance from Baltimore on good roads, and land along the State highways sells for more than the same kind of soil several miles back. The selling prices range ordinarily from about \$40 to \$125 an acre.

SOILS.

Howard County lies principally within the northern division of the Piedmont Plateau, which extends along the eastern flank of the Appalachian Mountain system. About one-sixth of the county, consisting of a belt approximately 4 miles in width along the southeastern boundary, is within the Coastal Plain. This province is separated from the Piedmont by a line extending in a general north-east-southwest direction. The boundary between these provinces is fairly well defined geologically and in soil characteristics, but is quite irregular, owing to the unequal action of erosion.

The soils of Howard County may be classed in three groups, namely, residual soils, formed by the disintegration and decomposition of the underlying rocks of the Piedmont Plateau; soils of the Coastal Plain, derived from sedimentary material deposited on a former ocean bed; and alluvial soils, consisting of recent sediments deposited along the various streams of the county.

The rocks of the Piedmont Plateau in Howard County are of igneous and metamorphic origin. They consist of granite, gabbro, diabase, serpentine, gneiss, and schist, with some shale and slates derived from metamorphosed argillaceous sediments. The weathering of these rocks has resulted in a relatively deep accumulation of soil material over large areas. In places the material has a depth of 30 feet. It is deeper over the granites and gneisses than over the other crystalline rocks.

The Coastal Plain material in the southeastern part of the county consists of unconsolidated, interstratified beds of gravel, sand, and clay. This material was brought down in former ages by various rivers from the Appalachian, Piedmont, and limestone-valley regions, more or less reworked by the sea, and deposited as a relatively thin layer over crystalline rocks.

The alluvial soils occur in strips along streams throughout the county. They consist of material washed from local areas, and receive fresh sediments from the overflow waters of the streams.

The various soil-producing materials differ in lithologic character, and the influences of weathering acting differently on these materials give rise to differences in the resultant soils. The soils having common characteristics in color, origin, and structure are grouped into series, which include types differing only in texture. The Piedmont soils derived from the igneous and metamorphic rocks are classed in the Chester, Manor, Montalto, and Mecklenburg series, and those derived from schists metamorphosed from sediments in the Manor and Lehigh series. The Coastal Plain sediments have produced the soils of the Leonardtown, Sassafra, and Susquehanna

series. The alluvial soils, washed from Piedmont uplands, are grouped in the Congaree series, and those formed from Coastal Plain wash in the Ochlockonee series.

The types grouped in the Chester series have brown to yellowish soils, and are underlain by yellow to brown subsoils. This series is very extensive in the northern Piedmont and covers by far the larger part of Howard County. It is here derived mostly from the crystalline rocks, including granite, gneiss, and schist. In a small total area in the western part of the county where the series has been formed from schists the surface soils are browner than in the areas derived from granite and gneiss in the eastern part of the county, and the subsoil is somewhat more friable, owing to an admixture of finely divided mica flakes. One type of this series, the loam, with a stony phase, is mapped.

The surface soils of the Manor series are light brown to yellowish, with reddish or reddish-yellow to brown subsoils. The material is characteristically micaceous, especially in the subsoil, and has a greasy or slick feel. This series is derived from the weathering of schist, slate, gneiss, and granite. It is represented by three types—the stony loam, the slate loam, and the loam, micaceous phase. The Manor slate loam is derived from the weathering of schist or slate metamorphosed from argillaceous sediments.¹ The Manor stony loam is derived from schists and slates where erosion has been almost as rapid as weathering. The Manor loam, micaceous phase, is the product of weathering and disintegration of micaceous gneiss and schists, though in some places where the soil is very gritty it comes from granite. A soil derived from small outcrops of phlogopitic limestone has been included with this phase.

The Montalto series comprises types with brown to reddish-brown surface soils and deep-red subsoils. Only one type of this series—the clay loam—is mapped. This type is derived mainly from gabbro, but a small part owes its origin to diabase.

The soils of the types included in the Mecklenburg series are brown in color and are underlain by a yellowish-brown to greenish-yellow subsoil, the latter being more pronounced in the lower subsoil, though present throughout the soil mass as small spots or minute mottles. These soils resemble the Chester soils on the surface. They are derived from gabbro. One type of the Mecklenburg series, the loam, is mapped in Howard County.

The Lehigh series includes types with gray to bluish surface soils, and yellowish to brown subsoils. One type, the slate loam, is

¹ In reports of the Maryland Geological Survey these rocks are included in a group, under the title, "complex unmapped."

mapped. It is derived mainly from a bluish fine-grained slate and perhaps in part from a yellowish schist.

The Leonardtown series includes types characterized by pale-yellow to yellow soils and subsoils. The immediate surface when dry has a whitish appearance. The subsoils are very compact in the lower part of the 3-foot section. The series is derived from Coastal Plain sediments. Only the loam of this series is mapped in this county.

The Sassafras series comprises types with brown to yellowish-brown surface soils, and reddish-yellow to brown or reddish-brown, friable subsoils. These soils represent Coastal Plain sediments more highly weathered and more thoroughly aerated than those giving rise to the Leonardtown soils. Two types, the loamy sand and loam, are mapped.

The types included in the Susquehanna series are characterized by yellow soils and a heavy, plastic, mottled red, or pink and gray, clay subsoils. Only one type of the series, the silt loam, is mapped.

The Congaree series comprises brown surface soils underlain by subsoils similar in color and texture to the surface soil. The soils of this series are found along streams in the Piedmont section of the county and are formed from wash from the upland Piedmont soils. The silt loam is the only type of this series mapped in this county.

The Ochlockonee soils are brown to yellowish brown in both surface soil and subsoil. They lie along streams of the Coastal Plain and are formed from material brought down from adjacent upland soils. The only type of the series mapped in Howard County is the loam.

The various soils mapped in Howard County are described in detail in the following pages of this report. The distribution of the soils is shown on the accompanying map, and the actual and proportionate extent of each is shown in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Chester loam.....	79,424	50.5	Manor stony loam.....	2,880	1.8
Stony phase.....	2,304		Montalto clay loam.....	2,432	1.5
Manor loam, micaceous phase...	30,208	18.7	Sassafras loamy sand.....	1,536	.9
Congaree silt loam.....	16,768	10.4	Ochlockonee loam.....	1,344	.8
Leonardtown loam.....	8,960	5.5	Lehigh slate loam.....	640	.4
Manor slate loam.....	7,296	4.5	Susquehanna silt loam.....	512	.3
Sassafras loam.....	4,416	2.7			
Mecklenburg loam.....	3,200	2.0	Total.....	161,920

CHESTER LOAM.

The surface soil of the Chester loam is a brown or yellowish-brown very mellow friable loam 6 to 10 inches deep. The subsoil is a yellow, yellowish-brown, or brown clay loam or occasionally clay or loam. Usually at 18 to 24 inches it grades into a loam which contains fine mica particles and is friable in the lower part. The surface soil and upper subsoil are occasionally slightly micaceous. Upon drying the surface soil has a grayish color, and in timbered areas it has a yellowish color owing to a lack of organic matter. The subsoil is sometimes reddish yellow, and the lower subsoil is in places a light reddish color.

A narrow strip of quartzite (Setters Ridge quartzite), closely associated with the gneiss, extends across the county and gives rise to an inextensive soil which so closely resembles the Chester loam that the two are mapped together. There are also included a few small areas of reddish soil derived in part from limestone.

Many small bodies having a brown to red surface soil and a light-red subsoil, which, if of sufficient extent, would have been mapped as Louisa loam, together with small bodies of Manor loam, micaceous phase, occur throughout the areas of the Chester loam. Many of these are too small to map separately and are included with the Chester loam. The reddish spots of Louisa loam on many of the slopes have given the local name of "red clay land" to the Chester loam. On these steeper slopes the subsoil of the Chester loam has a larger mica content and a more pronounced reddish cast. The Chester loam and Manor loam, micaceous phase, often merge into each other so gradually that boundary lines are necessarily arbitrarily placed, and to a greater or less extent on the basis of topography.

Usually the rocks underlying the Chester loam have weathered deeply. Small, irregular fragments of vein quartz, granite, gneiss, or schist may occur throughout the soil and subsoil, though not in sufficient quantity to interfere with cultivation. On some of the steeper slopes occasional outcrops of the underlying rocks occur, and near these the partially disintegrated rock gives a gritty, light, and somewhat porous structure. Where the type is derived from granite, in its eastern extension in this county, the immediate surface when dry has a light-grayish color.

The Chester loam is by far the most extensive soil type in the county, occurring in broad, continuous areas in all parts of the Piedmont section. Large connected bodies of the type occur around Columbia, Atholton, Elioak, Pine Orchard, Clarksville, Glenwood, and Cooksville.

The surface ranges from gently rolling to slightly hilly and rather steeply sloping. The typical soil occupies the more gently rolling

areas. On the steeper slopes the mica content of the subsoil is greater than in the true Chester subsoil. The type lies, in general, from 300 to 800 feet above sea level. Surface drainage is everywhere good, and on some of the steeper slopes erosion is serious unless careful tillage methods are used. The subsoil is retentive of moisture. Good springs occur in many parts of the type.

The Chester loam is the principal agricultural soil in Howard County. Practically all of it is either cultivated or used as pasture. The small area in forest is utilized for woodlots and pasture land. The original timber growth consisted mainly of chestnut, red oak, white oak, pine, poplar, and hickory.

The Chester loam is devoted principally to the production of the general farm crops, such as corn, wheat, and hay. Wheat is the principal cash crop, though corn and hay also are sold, a sufficient quantity being retained to feed the work stock, dairy cows, and beef cattle. Considerable dairying is carried on, and many hogs are raised. A number of farmers feed cattle purchased in West Virginia or Chicago.

Crop yields vary with the season and the fertilization. Corn yields from 40 to 80 bushels per acre, wheat 15 to 30 bushels, and hay 1 to 2 tons. The yields of the secondary crops are also good. Irish potatoes yield 100 to 200 bushels, rye 15 to 20 bushels, and barley 20 to 35 bushels per acre.

This soil is easy to cultivate. It does not readily clod or bake on drying and may be worked up into a seed bed of excellent tilth. The soil responds quickly to fertilization, and as it is generally farmed under good methods the greater part of the type is in a high state of productiveness. A systematic crop rotation is followed, corn being grown one year, wheat two years, and timothy and clover two years or more. Generally after the land has been in grass two years corn is again planted. Commercial fertilizers are invariably used for wheat and sometimes for corn. The fertilizers used vary in composition, but the mixture most commonly used contains 2 per cent nitrogen, 8 per cent phosphoric acid, and 2 per cent potash. Some farmers use ground phosphate rock alone, and some use phosphate rock and bone mixtures. About 350 to 500 pounds of fertilizer per acre is used for wheat. Practically all the type is limed. The applications range from 800 to 2,500 pounds per acre. Land to be used for corn is usually given heavy applications of stable manure. As a rule the soil is most productive where considerable manure is used, as on farms that carry on dairying and stock feeding.

Land of the Chester loam near railroads or well-improved highways sells for \$100 to \$125 an acre. At some distance from main lines of travel it may be bought for \$40 to \$80 an acre.

Under good farm practice the Chester loam can be made highly productive and be easily maintained in this condition, but if neglected it deteriorates rapidly. The use of lime once in every rotation, or not less than once in every two rotations, is recommended. For best results the soil must be well supplied with organic matter. Where sufficient manure is not available the plowing under of green-manure crops should be resorted to. Merely growing leguminous crops, such as the clovers, cowpeas, and alfalfa, improves the soil in this respect, as the roots go deep and add much organic matter when the sod is plowed under. The purchase of nitrogen in fertilizers is less necessary when any or all these means are used to keep the soil well supplied with organic matter.

A number of small fields of alfalfa on this type have given results indicating that this crop could be profitably grown on a larger scale. In preparing for this crop the soil must be limed, inoculated, manured, or fertilized, and rendered as free from weed seed as possible. Crimson clover improves the soil greatly, and should be grown more extensively.

The Chester loam is well suited to certain varieties of apples, peaches, pears, plums, and cherries. Nearly every farm has a well-kept small orchard of apples and some of the other fruits, and indications are that these could be produced profitably on a commercial scale.

Chester loam, stony phase.—The Chester loam, stony phase, is quite similar to the typical Chester loam in color, texture, and structure, differing only in its content of stones. If more extensive, it would be mapped separately as the Chester stony loam. It is differentiated on the map from the typical Chester loam by stone symbols. The fine earth of the soil consists of about 6 inches of brown or yellow loam. The fine earth of the subsoil to a depth of 36 inches is a yellow or yellowish-brown loam to clay loam, containing sufficient finely divided mica to have a smooth, greasy feel. Scattered over the surface and throughout the soil mass are a considerable number of schist, gneiss, and quartz fragments, mainly under 12 inches in diameter. There are also some outcropping ledges of these rocks. In the vicinity of Ellicott City areas of this phase along the Patapsco River consist of outcrops and stony areas of gabbro.

The Chester loam, stony phase, is of very small extent. It occurs in only a few narrow strips along steep slopes adjacent to the larger streams. The largest areas occur near Watersville and between Ellicott City and Davis. The land is hilly to steeply sloping, and surface drainage is excessive. Practically all the phase supports a forest of chestnut, red oak, white oak, hickory, poplar, and other trees. A few small patches are used for the production of the general farm crops, which give only moderate yields. The phase is valu-

able principally as forest land, and this is its present use. It is in general too rough for profitable cultivation, a few bodies being in reality Rough stony land, though, on account of the small extent, not shown separately.

MANOR STONY LOAM.

The surface soil of the Manor stony loam consists of 6 or 8 inches of brown or yellowish-brown or, in forested areas, yellowish loam. The subsoil to 36 inches is a reddish-yellow, pale-reddish, or yellowish-brown loam or clay loam. Both surface soil and subsoil are somewhat greasy and slick to the feel, owing to the high content of finely divided mica particles. On the surface and throughout the surface soil and subsoil there are many flat, platy schist fragments, ranging up to 6 or 8 inches in diameter. The partially weathered bedrock usually lies within a few feet of the surface and in places outcrops. The rock fragments interfere somewhat with cultivation.

This is an inextensive soil, occurring in only a few narrow areas in the extreme northern and northwestern parts of the county, on steep slopes along the headwaters of the Patapsco and Patuxent Rivers. Owing to the steep topography, surface drainage is thorough, and damaging erosion takes place unless the land is protected.

Probably 50 per cent of this soil is in cultivation, the remainder supporting a forest of chestnut, white oak, red oak, poplar, and hickory. Where the soil is cultivated carefully and its productivity well maintained fair crops of corn, wheat, and hay are grown. On the better farms corn has yielded 25 to 50 bushels, wheat 10 to 18 bushels, and hay 1 to 1½ tons per acre.

The soil is farmed in much the same way as the Chester loam. Considerable care should be given to the preventing of erosion. The methods of improvement given later for the Manor loam, micaceous phase, apply also to this soil.

MANOR SLATE LOAM.

The surface soil of the Manor slate loam is a brown silty loam containing small, fine, schist and impure-quartz fragments. At a depth of 6 or 8 inches the soil changes abruptly to a yellow or yellowish-brown silty loam or sometimes silty clay loam subsoil. The surface soil and subsoil, especially the latter, have a very slick, greasy feel, probably due to very finely divided mica. Frequently the lower subsoil has a reddish or pinkish shade. Small, soft, flat fragments of schist of yellowish color, bluish slate fragments, and pieces of impure quartz are scattered over the surface and throughout the soil section. On the slopes the soil mass is composed very largely of these fragments, but on the broader divides the surface soil carries fewer than the subsoil.

The Manor slate loam occurs in the extreme northwestern part of the county in a few areas aggregating several square miles in extent. The village of Long Corner is situated on this soil.

The type has a rolling to hilly topography. The surface is deeply cut by many small branch streams occupying deep valleys with steep but smooth and regular slopes. Surface drainage is everywhere thorough, and damage results from erosion where care is not taken to prevent it. Underdrainage is good, owing to the mass of partially weathered schist fragments in the substratum. The subsoil and substratum are nevertheless sufficiently heavy to hold a good supply of water for growing crops, and the soil is not droughty.

Probably 90 per cent of the type is cultivated, and many fine farms are located on it. Small bodies of forest remain, consisting principally of chestnut, red oak, white oak, hickory, and poplar.

The Manor slate loam is devoted principally to the general farm crops, corn, wheat, and hay. Small acreages of barley and rye are grown by some farmers. Formerly many grew small fields of tobacco on this soil. Dairying is carried on in a small way, and some beef cattle are fed.

Part of the type has recently been used for the production of corn, tomatoes, and other canning crops for canneries located at Mount Airy, Woodbine, and Watersville.

Corn yields 30 to 70 bushels per acre, wheat 15 to 30 bushels, and hay 1 to 1½ tons. A yield of 600 or 800 pounds of tobacco per acre is considered good. Rye yields 12 to 20 bushels and barley 20 to 30 bushels per acre.

The Manor slate loam is farmed and fertilized in practically the same way as all the other residual soils of the county, as described in detail under the Chester loam. Commercial fertilizers are used for wheat and sometimes for corn. Heavier applications are made for tobacco than for any other crop. Much of the type has been brought to its present high state of productiveness by the use of lime, barnyard manure, and commercial fertilizers.

The Manor slate loam varies in selling value from place to place, depending on the location, topography, and improvements. Some farms are held for more than \$100 an acre, but the ordinary price of land of this type is \$40 to \$75 an acre.

The suggestions made for the improvement of the Chester loam apply equally well to the Manor slate loam.

MANOR LOAM, MICACEOUS PHASE.

The surface soil of the Manor loam, micaceous phase, is a brown, friable loam, 6 to 10 inches deep. The subsoil to 36 inches is a brown, reddish-brown, reddish-yellow, or light-red loam to clay loam.

Both surface soil and subsoil contain a large quantity of finely divided mica, which gives them a slick, greasy feel and an open, friable, porous structure. The mica content usually increases with depth, until, in places at 24 to 36 inches, the soil mass is simply a bed of loose, finely divided mica particles. In areas derived from granite the subsoil is often a gritty, micaceous loam, containing a large quantity of fine rock particles. Small bodies of Chester loam and Louisa loam are included in the large areas of this type, and the lines of separation between the areas of Manor loam, micaceous phase, and Chester loam are frequently arbitrarily placed, as these types merge into each other very gradually. Small quartz, granite, gneiss, or schist fragments occur upon the surface and throughout the soil and subsoil. These are not numerous enough to hinder cultivation. Locally this soil is known as "isinglass land."

A belt of soapstone and pyroxenite, extending in a northeast-southwest direction across the county near West Friendship, gives rise to a narrow area of reddish soil which resembles the Manor loam, micaceous phase, in many respects. Both surface soil and subsoil are very slick and greasy from large quantities of fine soapstone particles, and the partially decomposed rock is often encountered at 18 inches. As this soil is very inextensive and intricately associated with the Manor loam, micaceous phase, it is included with that type.

The Manor loam, micaceous phase, occurs in a large number of small bodies throughout practically all parts of the Piedmont section. Some of the larger areas are mapped around Roxbury Mills, West Friendship, Sykesville, Simpsonville, and along the Patuxent River, west and southwest of Highland. Many very small areas of the type are included in the areas of Chester loam, being too small and too intricately associated with that type to make separation practicable.

The surface of the Manor loam, micaceous phase, is prevailingly rolling to hilly. As a rule it occupies the steeper slopes in regions where the more gently sloping land is occupied by the Chester loam. The Manor areas, however, are usually smooth, and practically none of the land is too steep for cultivation. Drainage is good, and in places erosion is excessive, especially where the ground is left bare. Where there is an unusually large content of mica in the subsoil it is rather porous and leachy, but on many farms careful handling has eliminated to a considerable extent the bad effects of this structure.

The Manor loam, micaceous phase, is a rather important soil in Howard County, although few farms are situated entirely on it. A very large part of the phase is in cultivation, possibly 85 per cent. Small areas are still in forest similar to that found in places on the Chester loam.

The most important crops are corn, wheat, and hay. The acreage in corn is probably somewhat greater than that devoted to wheat, although wheat is the principal cash crop. Some corn and hay are sold from many farms. Dairying is carried on to some extent. A few hogs are raised, and some steers are fed on many of the farms situated partly or wholly on this soil. In certain localities market-garden and fruit crops are grown for the local and Baltimore markets. There are a few small commercial orchards of apples, peaches, pears, plums, and cherries. Potatoes are grown by a number of farmers in patches of 3 to 15 acres. They are sold mostly in Baltimore. Rye and barley occasionally are grown in small fields.

Crop yields on the Manor loam, micaceous phase, vary greatly. On the better farms corn yields from 30 to 70 bushels per acre, depending on the season; wheat 12 to 25 bushels; and hay about 1 ton. Irish potatoes yield 100 to 150 bushels per acre. Rye and barley produce fairly good yields.

The soil is very easy to cultivate. It does not bake badly on drying and responds quickly to improved methods of cultivation and to fertilization. Under good farm practice a fair degree of productiveness can be maintained. A systematic crop rotation, practically the same as that followed on the Chester loam, is employed. Commercial fertilizers are used for wheat and potatoes, and occasionally for corn. Practically the same preparations are used as on the Chester loam, and in approximately the same quantities. Lime is used on all farms, in acreage applications varying from 800 or 1,000 pounds of hydrated lime to 25 or 30 bushels of burnt lime. The former is used for quick results every two to four years, while the burnt lime, where used, is applied less frequently. All the stable manure available is used, mainly on corn land, and gives excellent results.

Farms composed entirely or largely of this soil sell for \$40 to \$100 or more an acre, depending upon the location, topography, improvements, and state of productiveness.

The Manor loam, micaceous phase, varies considerably in productiveness, but as a rule the farms are fairly good. The use of lime is essential for best results, and it is necessary that the soil be well supplied with organic matter. The growing of cowpeas, clovers, alfalfa, and other leguminous crops greatly improves the soil. By maintaining a good supply of organic matter its porous and leachy nature is partially overcome. Particular care should be given to the prevention of erosion, and a system of terracing might prove beneficial in places.

The condition of a number of small fields of alfalfa on some of the better farms indicates the possibility of growing this crop on a much larger scale than at present. The soil should be carefully pre-

pared, limed, manured, and inoculated. Crimson clover is also a good crop for improving the soil.

The Manor loam, micaceous phase, is well adapted to the production of potatoes, vegetables, tree fruits, and small fruits. It seems to be better adapted to corn than to the small grains.

LEHIGH SLATE LOAM.

The surface soil of the Lehigh slate loam is a dark-gray to bluish silty loam 6 or 8 inches deep. The subsoil is a brown or yellowish-brown silty loam or silty clay loam. A large number of small, thin, yellow and bluish slate fragments and impure-quartz fragments are scattered over the surface and throughout the surface soil and subsoil. On the steeper slopes the bluish slate rock comes near the surface and sometimes outcrops. Small areas are so stony as to be a stony loam. The Lehigh slate loam is locally called "blue slate land" and "spouty land." The immediate surface when dry is a very light gray.

This type occupies three small, narrow areas in the extreme northwestern part of the county 3 or 4 miles south of Mount Airy. They are surrounded by the Manor slate loam.

The surface of the type is rolling to hilly, and drainage is thorough. Where unprotected the surface washes badly. The land may become very dry in periods of drought and is very wet or "spouty" in wet weather or just after rains.

About 90 per cent of the type is cultivated. Small bodies of the original forest, consisting of chestnut, white and red oak, and poplar, still remain. The same crops are grown as on the Manor slate loam, and the type is handled and fertilized in about the same way. Yields are somewhat smaller as a rule. Rye is said to give somewhat better results than wheat.

MONTALTO CLAY LOAM.

The surface soil of the Montalto clay loam consists of a brown or reddish-brown, friable clay loam about 6 or 8 inches deep. The subsoil to a depth of 36 inches is a rather heavy but crumbly red or brownish-red clay. In places partly rounded fragments of gabbro are scattered over the surface and throughout the soil mass, some of them ranging up to several feet in diameter. Locally this soil is called "red clay" or "clay" land.

The Montalto clay loam is inextensive in Howard County. It occurs in a few relatively small areas scattered throughout the eastern part of the county. The largest, containing about 2 square miles, lies northwest of Savage.

The type has a rolling to gently rolling surface, and sometimes occupies the smoother crests of ridges. Surface drainage is good,

and on some slopes erosion is active, especially where the soil is unprotected by vegetation. In places here the clay subsoil is exposed.

The Montalto clay loam is a rather valuable soil and probably 80 per cent of it is in cultivation. The uncultivated land remains in the original forest growth, consisting principally of white oak, hickory, pine, cedar, poplar, and chestnut.

The most important crops on this soil are corn, wheat, and hay. There are some small orchards of apples. As much of the type is cultivated in fields composed largely of other soils, it is difficult accurately to state crop yields, but in ordinary seasons, according to statements of farmers, wheat yields 15 to 20 bushels, corn 30 to 50 bushels, and hay 1 to 2 tons per acre.

The soil of the Montalto clay loam, being rather heavy, is somewhat difficult to cultivate. If plowed when too wet, it bakes into clods which are later broken down with difficulty. If allowed to become too dry, the soil assumes a compact, hard structure and is very difficult to plow. This refractory condition is especially pronounced in spots where the clay subsoil is exposed or comes near the surface. As a rule it is handled and fertilized in practically the same way as the Chester loam.

Farms composed in part of the Montalto clay loam sell for \$60 to \$100 an acre.

This type requires liming every few years, and a good supply of organic matter should be maintained. The growing of leguminous crops is very beneficial. Where the soil has been well limed and brought to a high state of productiveness, alfalfa should do well. The use of barnyard manure is especially advisable for corn and hay crops. The soil is well adapted to small grains among the field crops and to apples among the orchard products. Deeper and more thorough plowing would increase the yields. The rocks from which the Montalto clay loam is derived contain lime, but in weathering this is probably mostly removed from the surface soil. While the lower subsoil may contain considerable lime, the use of lime on the surface soil will doubtless always prove beneficial.

In the following table are shown the results of the mechanical analyses of samples of the soil and subsoil of the Montalto clay loam:

Mechanical analyses of Montalto clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
201113.....	Soil.....	2.6	6.4	3.2	9.8	6.2	48.9	23.0
201114.....	Subsoil.....	2.4	6.0	2.4	8.0	6.0	43.5	31.9

MECKLENBURG LOAM.

The surface soil of the Mecklenburg loam is a brown loam, 8 or 10 inches deep. The subsoil to 18 or 24 inches is a yellowish-brown or reddish-yellow clay loam or clay, usually friable and slightly slick and greasy, and frequently having a greenish tinge. The subsoil grades at depths ranging from 18 to 24 inches into a more or less micaceous, gritty loam, which extends to 36 inches or more. This lower subsoil, which comes near the surface on some of the steeper slopes, appears to consist largely of disintegrated rock in place. It is mixed black, brown, and yellow in color, with a distinct greenish tinge. The immediate surface material when dry has a dark-grayish color. There is considerable variation in the color and texture of the subsoil.

Throughout the areas of the type there occur very small bodies of a very gritty phase of the Chester loam. These areas are derived from the small dikes of pegmatite occurring throughout the areas of gabbro from which the Mecklenburg loam is derived. Small fragments of gabbro are scattered over the surface in places.

The Mecklenburg loam is a relatively inextensive type in Howard County. It occurs in a few areas in the northeastern part, the largest two occurring just south of Ellicott City and northwest of Elkridge.

The greater part of the type is quite rolling to hilly. It occupies some steep slopes adjacent to the Patapsco River and some of its tributaries. It has thorough surface drainage, and in places where not well protected it is severely eroded.

The native growth on this soil includes white oak, chestnut, pine, and other trees. Probably 75 per cent of the type is in cultivation or utilized for pasture. There are some good farms on this soil near Ellicott City. The type is devoted principally to the production of corn, wheat, and hay. Some potatoes and other vegetables are grown for market. The soil is farmed in practically the same way as the Chester loam. On the better farms crop yields are good, corn giving about 30 to 60 bushels per acre, wheat 18 to 30 bushels, and hay 1 to 1½ tons. Apples, pears, small fruits, and berries do well.

For the improvement of this soil the same methods may be employed as on the Chester loam. Farms on this soil sell for \$50 to \$100 an acre.

The following table shows the results of the mechanical analyses of the soil and subsoil of the Mecklenburg loam:

Mechanical analyses of Mecklenburg loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
201115.....	Soil.....	2.2	3.6	3.4	26.2	11.8	37.6	14.8
201116.....	Subsoil.....	1.6	5.2	5.2	30.6	11.6	25.1	20.1
201117.....	Lower subsoil...	2.8	8.4	8.0	39.6	13.4	16.4	11.4

LEONARDTOWN LOAM.

The surface soil of the Leonardtown loam is a pale-yellow loam. The surficial 1 to 3 inches is a light-gray to whitish silty loam, which on drying in cultivated fields presents a nearly white appearance. At a depth of about 6 or 8 inches the soil grades into a yellow to yellowish-brown clay loam or silty clay loam, which at depths ranging from 18 to 24 inches becomes quite compact and in places carries considerable fine and small rounded quartz gravel. In many places the lower subsoil consists simply of compact silty clay loam faintly mottled with gray, the gravelly compact layer lying deeper than 36 inches. This compacted subsoil stratum, which is locally known as "hardpan," is more pronounced in nearly level or undulating areas than on the steeper slopes. Occasionally thin layers of ferruginous sandstone, sometimes in the form of conglomerate, occur in the compact subsoil. A small quantity of rounded quartz gravel in places is scattered over the surface and mixed with the soil and subsoil.

Small areas of Leonardtown silt loam, Sassafras gravelly loam, and Susquehanna silt loam, too small to map separately are included with this type. The largest of these occur about 2 miles northeast of Pfeiffer Corners, where they occupy the flat tops of the ridges.

The Leonardtown loam is the most extensive of the Coastal Plain soils. Some of the areas cover several square miles, but they are interrupted by numerous small bodies of other Coastal Plain soils. The largest areas of the type occur just north of Laurel, around Savage, Waterloo, Pfeiffer Corners, Dorsey, and West Elkridge.

The surface of the Leonardtown loam is prevailingly undulating to gently rolling. A few practically level areas occur on the broader ridges. The type ranges in elevation from less than 200 to a little more than 300 feet above sea level. Surface drainage is quite good over most of the type, but in occasional small areas water may stand on the surface in rainy seasons. Erosion has gullied some fields on slopes where the soil is unprotected. Underdrainage is in most places rather poor, as the compact condition of the lower subsoil prevents a ready downward movement of water.

The Leonardtown loam is the most important Coastal Plain soil in Howard County. Probably 70 per cent of it is cultivated or in pasture. The forest growth consists of pine, chestnut, white oak, and gum, with an undergrowth of laurel.

The most important crops on this soil are corn, wheat, and hay, though much of the type is devoted to the production of vegetables for market. Where general farming is carried on the land is handled and fertilized in the same way as the Chester loam, and the same rotation is practiced. The vegetables grown on the truck farms are principally tomatoes, potatoes, beans, peas, cabbage, peppers, egg-plant, and sugar corn. In those areas of the type lying farthest north, these vegetables are hauled to market in Baltimore. Tomatoes are also sold to canneries at Baltimore and Jessups, and to some others just outside the county. Considerable sugar corn also is sold to canneries. Fruit, consisting principally of apples, pears, and peaches, is grown in small orchards for sale on the local markets or to canneries. A combination of general farming in connection with market gardening, dairying, and fruit growing is carried on in many places.

Wheat ordinarily yields from 12 to 20 bushels per acre, corn 25 to 40 bushels, and hay about 1 ton. Irish potatoes average about 100 to 125 bushels per acre, and tomatoes as much as 2 to 3 tons.

The Leonardtown loam, where rather silty, bakes and clods on drying, especially where the organic content is low. Where a good content of organic matter is maintained, the soil is generally not very difficult to plow and cultivate when dry. Some farms on this type are quite productive. Where good farming methods are used and the land is limed, manured, and fertilized, it responds well, but where careless methods have been practiced its present productiveness is low. The same rotation is practiced as on the Chester loam. The soil is fertilized, manured, and handled in practically the same way as that type, except that market gardeners frequently make heavy applications of fertilizer and manure, and often use a somewhat higher grade fertilizer than is used for wheat.

Land of this type usually sells for \$40 to \$100 an acre, the price depending on the improvements and transportation facilities. Land along the Baltimore-Washington Road brings the highest prices.

The Leonardtown loam is naturally quite deficient in organic matter, and vegetable matter should be plowed under. The soil is improved greatly by growing legumes, such as clovers and cowpeas. It should be plowed rather deeply and thoroughly pulverized. Burnt lime or ground limestone should be used, probably as often as once in each rotation, and heavy applications of manure are especially desirable for corn, grass, clovers, and vegetables. It seems probable

that tile drainage would improve this soil generally, by giving more thorough underdrainage and aeration. Wheat would then probably suffer less damage by freezing.

SASSAFRAS LOAMY SAND.

The surface soil of the Sassafras loamy sand consists of about 10 inches of a pale-yellow or yellowish-brown loamy sand, the surface 2 or 3 inches assuming a dull-gray color when thoroughly dry. The subsoil to 36 inches is a pale-yellow or yellowish-brown loamy sand or occasionally sandy loam. Frequently there is a small content of fine quartz gravel and coarse sand in the surface soil and subsoil, the quantity being large enough to give a coarse sand texture in places. In a small area in the vicinity of Jessups the surface soil and subsoil range in color from brown to reddish brown. Other spots in the same locality consist of the Sassafras fine sandy loam.

The Sassafras loamy sand is of small extent in Howard County. It occurs in a number of widely separated bodies in the Coastal Plain part of the county. The largest lie near Laurel, Montevideo, Pfeiffer Corners, and West Elkridge. The type is closely associated with the Leonardtown loam.

The Sassafras loamy sand has a gently rolling surface, and usually occupies the higher ridgelike areas or knolls of the drainage divides. It has good surface drainage and underdrainage, but the soil is sufficiently loamy to hold moisture fairly well.

Probably 50 per cent of the type is in cultivation, the remainder being forested with black oak, chestnut, pine, and some other trees. The most important crops are vegetables, grown for the local and Baltimore markets and for canning. Very little corn, wheat, or hay is grown. Apples, pears, and peaches are successful crops in small orchards, and various small fruits, including strawberries and other berries, are grown in a small way.

The soil is very easily tilled. It dries out rapidly, warms up quickly in the spring, and produces good yields of the early vegetables. Commercial fertilizers and manure give good results and are used to some extent. The type is deficient in organic matter and nitrogen. The texture is too light for good results with wheat or grass or the best results with corn. The type is especially suited to the production of early vegetables and berries.

SASSAFRAS LOAM.

The surface soil of the Sassafras loam is a brown or yellowish-brown loam, the immediate surface having in places a rather grayish color when dry. At a depth of about 8 inches the surface soil is un-

derlain by a yellowish-brown, brown, or occasionally reddish-brown to light-red clay loam subsoil, which extends to 36 inches or more. The surface soil and subsoil frequently contain much small, rounded quartz gravel. The subsoil is in places slightly compacted at 24 to 36 inches, and carries considerable gravel here, but the compaction is less than in the Leonardtown soils.

The Sassafras loam is of small extent. It occurs in close association with the Leonardtown loam and is not everywhere typical, as it resembles the latter type somewhat in color and texture in places. It occurs in scattered areas, the largest containings about 2 square miles, in the southeastern part of the county. The surface is mainly gently rolling, but a few areas occupy rather steep slopes. Surface drainage is good and the underdrainage is usually sufficient for good aeration. The subsoil is retentive of moisture, and with proper cultivation crops do not suffer unduly in dry seasons.

The Sassafras loam is considered a good soil for the general farm crops, and most of it is in cultivation. The forest growth consists largely of chestnut, white oak, and red oak. The leading products are corn, wheat, hay, potatoes, and truck crops. Apples, pears, and peaches are doing well in some orchards. Crop yields on farms composed principally of this type are approximately as follows: Corn 30 to 60 bushels per acre, wheat 15 to 25 bushels, hay about 1 to 1½ tons, and potatoes 100 to 150 bushels. Yields may be somewhat higher on the better farms in especially favorable seasons.

The soil works into a friable seed bed without difficulty. It responds to good cultivation. The same rotation is practiced as on the other soils. Lime and fertilizer are used in approximately the same way as on the Chester and Leonardtown loams. Potatoes and vegetables are most liberally fertilized.

Farms on this type sell for about the same prices as the better farms on the Leonardtown loam in the same locality.

This soil varies in productiveness according to the methods of farming and cultivation. The means of improvement suggested for the Chester loam may be used to advantage on this type. Fertilizers somewhat higher in nitrogen and phosphoric acid may probably be needed. The Sassafras loam is well suited to apples, peaches, plums, cherries, small fruits, berries, and late vegetables.

A number of small areas of Sassafras loam shown on the soil map with gravel symbols, represent the Sassafras gravelly loam. The surface soil of this type is a yellow to yellowish-brown loam, 10 to 12 inches deep, drying out to gray in the surface 2 or 3 inches. It contains considerable small, smooth, well-rounded quartz gravel. The subsoil to a depth of several feet is a yellow to yellowish-brown loam or clay loam, carrying a very large percentage of the same gravel. In a few small areas both surface soil and subsoil are a

sandy loam. The Sassafras gravelly loam occupies narrow ridges and the higher parts of some slopes, being usually surrounded by areas of Leonardtown loam. Surface drainage and underdrainage are rapid. The soil dries quickly and is not retentive of moisture. Probably not more than 10 per cent of the type is cultivated, the remainder supporting a growth of chestnut, pine, black oak, some white oak, and hickory. Where the gravel content is not high the soil produces fair yields of vegetables. It is rather light for wheat, corn, and grass, and is not utilized for these crops to any appreciable extent. Small orchards of apples, pears, peaches, and plums seem to do fairly well in the heavier, less gravelly areas, and the soil is apparently well suited to grapes, berries, and small fruits. Liberal additions of manure, commercial fertilizers, and organic matter are necessary for best results.

SUSQUEHANNA SILT LOAM.

The surface soil of the Susquehanna silt loam consists of a pale-yellow silt loam, about 6 inches deep, which when dry is rather whitish in the surficial 1 to 2 inches. The subsoil to about 20 to 30 inches is a yellow, somewhat compact silty clay loam. This is underlain to a depth of several feet by a mottled red or pink and gray or bluish-gray heavy, plastic clay.

This type is of small extent in Howard County. The largest area occurs about 1 mile northeast of Waterloo, along the Baltimore-Washington Road. A few other small areas are mapped in the same vicinity. The surface is gently undulating and surface drainage is fairly good, but underdrainage, owing to the impervious nature of the lower subsoil, is poor.

This is an unimportant soil type, although it is mostly in cultivation, the untilled area supporting a forest of red oak, white oak, pine, and chestnut. The type is utilized principally for the production of corn, wheat, and hay, though some vegetables are produced. Crop yields are approximately the same as on the Leonardtown loam. The soil is rather heavy for best results with vegetables. It bakes rather hard on drying and is somewhat more difficult to cultivate than the Leonardtown loam. The type is handled, limed, and fertilized in practically the same way as the latter soil, with which it is closely associated in occurrence. The same methods of improvement should be used as are suggested for the Leonardtown loam.

CONGAREE SILT LOAM.

The surface soil of the Congaree silt loam to a depth of about 15 inches is a brown silt loam, often containing some fine mica flakes. The subsoil to 36 inches may be a brown loam or silt loam, but fre-

quently it consists of a silty clay loam with gray and rusty-brown or orange mottlings. There are some small and unimportant textural variations, the soil in places being a loam or even a sandy loam. Frequently the banks of the streams along which the type occurs comprise very narrow strips of the coarser textured soils, while along the border of the upland there are frequently strips of marshy land of very silty texture underlain by a mottled subsoil.

The Congaree silt loam occurs throughout the county except along some of the smaller streams in the southeastern part which originate or flow through the sedimentary or Coastal Plain soils. It occupies first bottoms ranging from a few hundred feet to one-fourth mile in width. It is necessary to exaggerate the width of some of these bottom-land areas in order to map them. The surface is mainly flat, but some of the wider areas are slightly depressed, and consequently more poorly drained, next to the uplands. The type lies 4 to 8 feet above the normal water level of the streams. Natural surface drainage is poor, and all the type may be overflowed several times during the year.

In the aggregate the Congaree silt loam has a considerable acreage, and there are few farms in the county that do not include some land of this type. Much of it is forested with pin oak, white oak, shingle oak, poplar, and sycamore, but about one-half of it has been cleared and supports a heavy growth of native grasses. The type is utilized almost entirely as pastures. Only a small acreage is cultivated. Corn, the chief crop grown, gives good yields in favorable seasons on well-drained land.

This is a good corn and grass soil, and it could be utilized for growing forage crops. It is naturally very productive, and with improvement in drainage, through ditching and the straightening and deepening of the streams, much more of it could be tilled. The danger of damage from floods probably precludes the general use of the land for cultivated crops.

OCHLOCKONEE LOAM.

The Ochlockonee loam to a depth of 36 inches or more consists of a brown loam, in places somewhat silty at the surface. The type is not uniform in texture throughout all the areas mapped, the soil frequently being a sand or sandy loam, especially near the stream bank.

This type occurs in several narrow strips along small streams in the southeastern part of the county which rise in, or flow through, areas of Coastal Plain soils. It lies 2 to 6 feet above the normal level of the streams. The surface is approximately level, but ordinarily drainage is fairly good. The type is subject to overflow several times during the year.

A considerable total area of the Ochlockonee loam is cleared, but it is used mainly for pasturage, owing to the danger of overflow. The forest growth is principally maple, pin oak, willow, sycamore, and other water-loving trees and shrubs. The type is well suited to the production of corn, and some small areas are devoted to this crop. It is also an excellent grass soil, and especially suitable for pastures.

SUMMARY.

Howard County lies in central Maryland, its eastern extension reaching within 8 miles of Baltimore. It is the second smallest county in the State, having an area of 253 square miles, or 161,920 acres.

The county lies principally within the Piedmont Plateau region. The southeastern one-sixth, approximately, is in the Coastal Plain. The topography ranges from undulating to very rolling, with some rather steep slopes along the larger streams. The only nearly level areas are the narrow stream-bottom lands.

The general slope is southeasterly. Elevations range from about 50 feet to a little over 850 feet above sea level. The greater part of the county lies between the altitudes of 300 and 700 feet. The county is drained principally by the Patuxent River and its tributaries, but a belt along the northern and eastern boundary is drained by the Patapsco.

The county is thickly settled. It had a population in 1910 of 16,106, all classed as rural. Over one-fifth of the population is colored. The principal town, Ellicott City, is the county seat. Smaller towns include Elkridge, Savage, and Sykesville. Laurel is just outside the county line on the southeast.

Trolley lines connect Ellicott City with Baltimore and Laurel with Washington. Lines of the Baltimore & Ohio Railroad follow the northeastern, northern, and southeastern boundaries of the county. Two excellent State highways traverse the county and other roads are improved. The county is well supplied with churches, schools, telephones, and rural mail-delivery service.

The mean annual temperature is about 55° F. There is an average growing season of 213 days. The yearly precipitation, mostly in the form of rain, averages 43.18 inches.

Farms in Howard County are generally well handled. Crops are systematically rotated, and lime, commercial fertilizers, and barnyard manure are in general use. Wheat, corn, and hay are the main crops, grown both for home use and for sale. Irish potatoes and other vegetables are grown in certain sections for sale in Baltimore and for canning. There are a few small commercial orchards

of apples, peaches, and pears. Dairying is carried on to a considerable extent, near the railroads and State highways. Some beef cattle are fed.

As a rule farm conditions are good. The houses are large and comfortable, and the barns, outbuildings, and improvements are substantial. Improved machinery is in general use.

The farms range in size from a few acres to several hundred acres. Most of them contain from 80 to 200 acres. The average size of farms in 1910 was 107.6 acres. Farm land generally sells for \$40 to \$125 an acre.

Baltimore is the principal market for the agricultural products of the county.

The soils of Howard County may be grouped as residual, those derived through weathering from the rocks of the Piedmont Plateau; sedimentary, those derived from unconsolidated Coastal Plain deposits; and alluvial, formed from recent stream deposits. The Piedmont rocks, consisting of granites, gneisses, schists, slates, gabbro, and diabase, give rise to the Chester, Manor, Lehigh, Montalto, and Mecklenburg soils; the unconsolidated Coastal Plain sediments give rise to the Leonardtown, Sassafras, and Susquehanna series of soils; and the recent-alluvial deposits to the Congaree and Ochlockonee series.

The Chester loam is one of the more important types of the county and by far the most extensive. The Manor soils are next in importance. The other soils are comparatively inextensive.

The Chester loam and Manor slate loam are well adapted to the production of corn, wheat, and hay. The Manor loam, micaceous phase, is an especially good potato and heavy-truck soil, and also is well adapted to fruit. The Montalto clay loam is a good small-grain and grass soil. The Sassafras loam is a fairly good corn and small-grain soil, and is also desirable for late vegetables and certain fruits. The Sassafras loamy sand is better suited to vegetables, small fruits, and berries than to general farm crops. The Leonardtown loam is probably best suited to the production of hay and small grain, but late vegetables also do well. The Susquehanna silt loam is better adapted to grass and small grains than to corn or vegetables. The Congaree silt loam and Ochlockonee loam are best suited to corn and grass.

The soils of Howard County are as a rule quite productive, and under good management they may be built up to a high state of productiveness. Conditions are favorable for the development of special lines of farming, such as dairying, market gardening, and poultry raising.

[PUBLIC RESOLUTION--No. 9.]

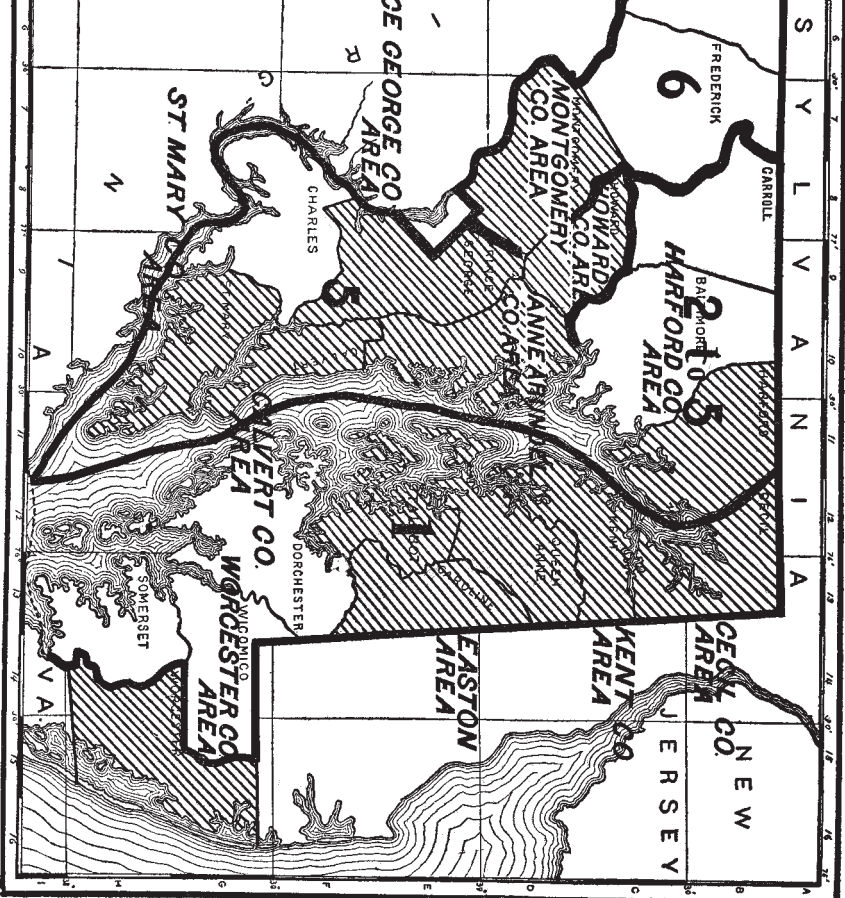
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture "

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Maryland.

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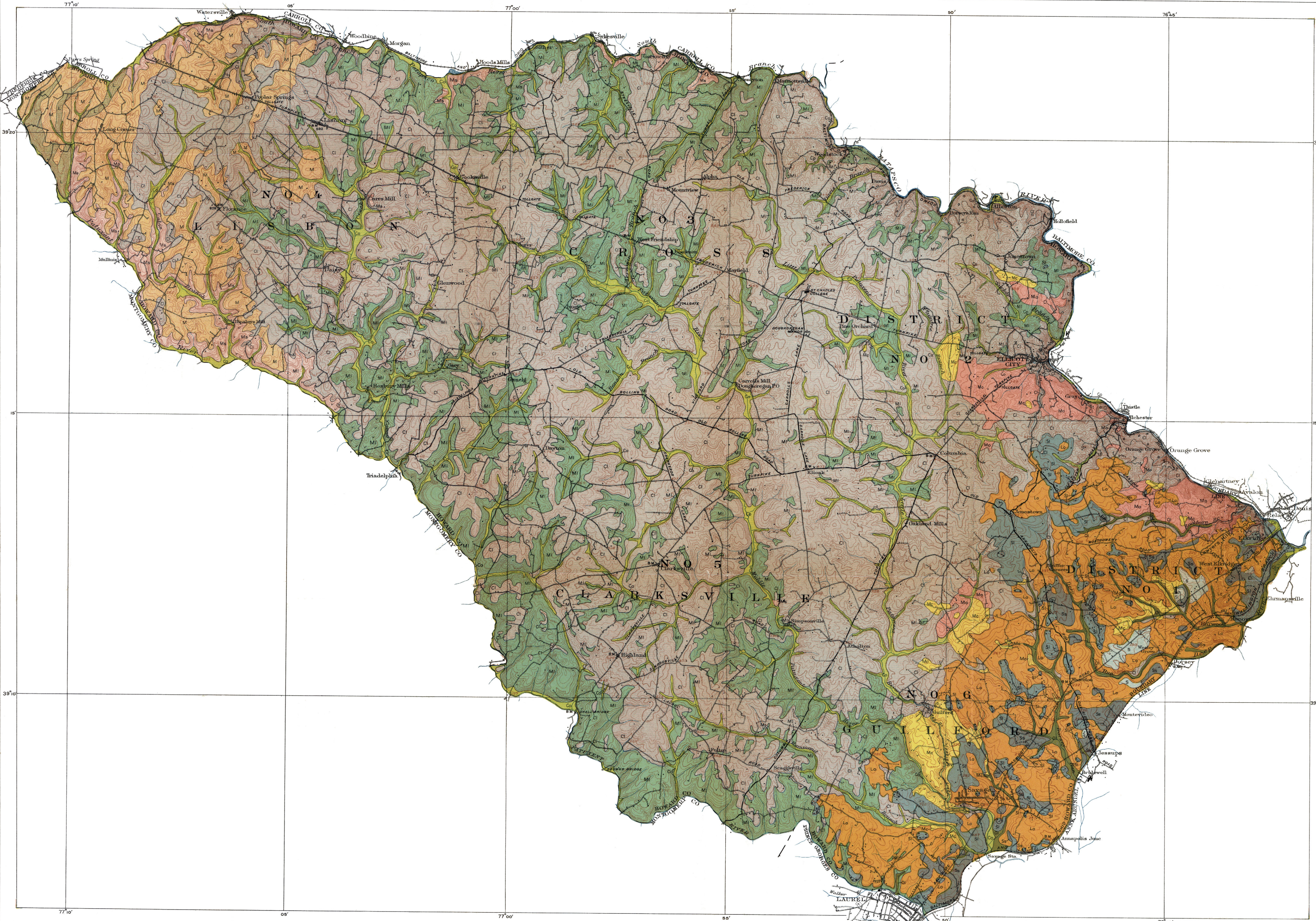
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LEGEND

Chester loam Cl	Sassafras loamy sand Ss
Stony phase s c l e s s a s	Sassafras loam Sl
Manor slate loam M	Mecklenburg loam Mo
Manor stony loam Ms	Leonardtown loam Lo
Manor loam Mi	Susquehanna silt loam S
Micaceous phase L	Congaree silt loam Co
Lehigh slate loam L	Ochlocknee loam Ol
Montalto clay loam Mc	

CONVENTIONAL
SIGNS

CULTURE
(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwaters, Levees, Lighthouse, Fort.	DOUBLE TRACK SINGLE TRACK RAILROAD H. ROAD
Secondary roads and Trails	Railroads Steam and Electric
Bridges, Ferry	R.R. crossings, Tunnel
Ford, Dam	School or Church Cemeteries
Mine or Quarry Mine dumps Made land	Butt, Escarpment Rock outcrop and Triangulation station
Stony and Gravelly areas	Soil boundaries
STATE COUNTY	LAND GRANT CITY OR VILLAGE
Boundary lines	Boundary lines
CIVIL TOWNSHIP RESERVATION	U.S. township and section lines

RELIEF
(Printed in brown or black)

Contours	Frontment Hills
Depression contours	Mountain Peaks
Sand Wash, and Sand dunes	Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

Streams	Lakes, Ponds, Intermittent lakes
Intermittent Streams	Springs, Canals and Ditches, Flumes
Swamp Salt marshes	Submerged marsh Tidal flats

The above signs are in
current use on the soil
maps. Variations from this
usage appear in some
maps of earlier date.